```
R version 4.2.2 (2022-10-31 ucrt) -- "Innocent and Trusting"
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Platform: x86_64-w64-mingw32/x64 (64-bit)

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  Natural language support but running in an English locale

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Type 'q()' to quit R.

[Previously saved workspace restored]

> #Function to return negative log-likelihood value
> logLikelihoodfn <- function(par, data) {
+   logLikelihood = length(data)*log(par)-(par+1)*sum(log(data))
+   return(-logLikelihood)
+ }
>
> #Optim function to minimize the negative log-likelihood value
> optim(par=1, fn=logLikelihoodfn,method = "L-BFGS-B", hessian=TRUE, lower=0.01, data=c(21.42,14.
65,50.42,28.78,11.23))
$par
[1] 0.3236796

$value
[1] 26.08744

$counts
function gradient
      11       11

$convergence
[1] 0

$message
[1] "CONVERGENCE: REL_REDUCTION_OF_F <= FACTR*EPSMCH"

$hessian
         [,1]
[1,] 47.72518

> #Function that returns negative log-likelihood value
> logLike <- function(theta, x) {
+ logLike = length(x)*log(theta)-(theta+1)*sum(log(x))
+ return(-logLike)
+ }
>
> #Optim function to minimize the negative log-likelihood value
> optim(par=1, fn=logLike,method = "L-BFGS-B", hessian=TRUE, lower=0.01, data=c(21.42,14.65,50.42
,28.78,11.23))
Error in fn(par, ...) :
  unused argument (data = c(21.42, 14.65, 50.42, 28.78, 11.23))
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> optim(theta=1, fn=logLike,method = "L-BFGS-B", hessian=TRUE, lower=0.01, x=c(21.42,14.65,50.42,
28.78,11.23))
Error in optim(theta = 1, fn = logLike, method = "L-BFGS-B", hessian = TRUE,  :
  argument "par" is missing, with no default
> #Function that returns negative log-likelihood value
> logLike <- function(par, x) {
+ logLike = length(x)*log(par)-(par+1)*sum(log(x))
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         [,1]
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>
> #Standard Error
> x<- optim(par=1, fn=logLikelihoodfn,method = "L-BFGS-B", hessian=TRUE, lower=0.01, x=c(21.42,14
.65,50.42,28.78,11.23))
Error in fn(par, ...) :
  unused argument (x = c(21.42, 14.65, 50.42, 28.78, 11.23))
> standardError <- (1/x$hessian)^(1/2)
Error: object 'x' not found
>
> #Confidence interval
> x$par + c(-1,1)*standardError*qnorm(0.975)
Error: object 'x' not found
> #Standard Error
> x<- optim(par=1, fn=logLikelihoodfn,method = "L-BFGS-B", hessian=TRUE, lower=0.01, d=c(21.42,14
.65,50.42,28.78,11.23))
> standardError <- (1/x$hessian)^(1/2)
> #Confidence interval
> x$par + c(-1,1)*standardError*qnorm(0.975)
[1] 0.03996984 0.60738939
Warning message:
In c(-1, 1) * standardError :
  Recycling array of length 1 in vector-array arithmetic is deprecated.
  Use c() or as.vector() instead.

>
```